

# ACTS Usage Policy

## 1. Policy Purpose

This policy has been developed to communicate the implementation of existing NASA policies in the area of cost reimbursement, as applied to the usage of the Advanced Communications Technology Satellite (ACTS), and to describe the process by which ACTS customers can request and use the available ACTS subsystems.

Consistent with a Federal Policy issued by the Office of Management and Budget (Circular A-25), NASA Headquarters' revised Financial Management Manual 9090, and in response to a request from ACTS Program management at Johnson Space Center, NASA Glenn Research Center is required to recover costs associated with the usage of the Advanced Communication Technology Satellite (ACTS) systems from its customers.

## 2. Applicable Charters in Regards to Communications Technology at NASA

### 2.1 ACTS Program Charter

The ACTS program performs its experimental operations under program direction from the NASA Space Operations & Management Office (SOMO) located at Johnson Space Center (JSC). Consistent with SOMO's Charter in the area of Communications Technology, it is the intent of the ACTS Management Team, to engage in technology verification and demonstration activities, based on the following ACTS Charter:

#### 2.1.1 ACTS Technology Verification Experiments

#### 2.1.2 Experiments and demonstrations benefiting the United States

#### 2.1.3 Experiments and demonstrations for specific organizations

The ACTS top level Program Plan in Section 9, describes the major elements of intended future ACTS activities, consistent with the above Charter.

### 2.2 Space Operations & Management Office (SOMO) Charter

As a result of reorganizations at NASA Headquarters, and the break-up of Office of Space Access and Technology (OSAT), certain aspects of OSAT's charter in the area of Communications Technology, have been delegated to SOMO. The Charter of SOMO in the Communications Technology is as follows:

#### 2.2.1 Commercial Communications Technology

#### 2.2.2 Integrated Operations Technology

## 3. Applicability and Scope of ACTS Usage Policy

This policy applies to all users of ACTS subsystems and terminals.

#### 4. Process for requesting ACTS system/subsystem usage

An overall description of ACTS satellite and ground segment capabilities can be found in subsequent paragraphs in this policy. An interested organization contemplating the usage of ACTS consistent with the Charters listed in Section 2, must submit a proposal to the following address:

NASA Glenn Research Center

21000 Brookpark Road

Cleveland, Ohio 44135

Attention: ACTS Manager, M.S. 54-6

In order to expedite the review and disposition of a proposal, the following information must be included with the proposal:

- The name, organization, address, e-mail address, phone, and fax number of the requester, and the technical point of contact for the requested activity. The name(s) of other organization(s) associated with performing, sponsoring, and/or funding the requested demonstration, experiment, or field trial, hereinafter, activity.
- The schedule of requested activities, i.e., the requested date for ACTS subsystem usage, the planned date of the proposed demonstration, plus any set-up and/or check-out dates associated with the request. Please indicate if any of the requested dates and times are flexible, otherwise we must assume non-flexible.
- A schedule of the needed satellite time in Eastern Standard Time (EST) for each requested date.
- A description of assistance and services requested from NASA.
- A description of the activity to include the following:
  - i. The overall objective of the proposed activity.
  2. A technical abstract including the following information:
    - a. A system diagram displaying the transmit/receive data rates, a list of all equipment requested from NASA, and a list of all other equipment associated with the activity
    2. A plan for testing and checkout of the activity

3. A chart indicating the roles and responsibilities of those performing the activity
  4. The address (or Latitude/Longitude) of all sites involved with the activity
- iii. A discussion of the following:
- a. The significance of using ACTS in the requested activity
  2. The intended target audience for the activity
  3. The method of display or handouts to be used (if any) showing ACTS participation in the activity
  4. The metrics to be used to determine whether or not the intended objective was met
- o An outline or abstract of a paper to be submitted to NASA upon the completion of the proposed activity.

Upon the receipt of the requested information, NASA will make a rough estimate of the cost associated with conducting the proposed activity, based on the general request and the Appendix, and will inform the requester. All requests will be time-stamped, and processed in a first-come-first-served basis. Once a verbal agreement has been reached between the ACTS Project Manager and the responsible individual within the requesting organization, to proceed to the next step, the NASA-identified technical lead will incorporate the available information into an appropriate draft agreement between NASA and the requesting organization for processing through to the final approval. It must be emphasized that at this point in the process, final approval to proceed with the proposed activity has not been granted. All agreements requiring significant NASA resources must be properly approved. The final approval to proceed with the proposed activity will be signified by an approved Space Act Agreement, or similar agreement between NASA and the requester. Therefore, the following items require careful attention by the requesting organization:

- o Completeness and accuracy of the response to the requested information in this Section is crucial in expeditious disposition of the proposed activity.
- o It is crucial for the requesting organization to allow sufficient time between the date when the information reaches NASA and the planned starting date of the proposed activity. Depending on the complexity of satisfying the request, and other ACTS commitments, the required planning time could range from four to eight weeks.

## 5. User Cost Computation

The cost computation of the proposed activity will be based on the responses given to

questions in Section 4, and the Appendix. The cost to perform an activity will include all costs to NASA to perform a given experiment or demonstration proposal. Upon receipt of a proposal, NASA will estimate the full cost (to NASA) to perform the proposed activity. Subsequently, the ACTS Management Team, and Space Operations and Management Office (SOMO), will make the final determination of the type of agreement required for the proposed activity, and what portion of the cost will be requested from the user (full cost or partial cost reimbursement.) The framework under which the final determination of User Cost will be made, is the charter of the ACTS program and the Space Operations & Management Office, displayed in Section 2. The final cost estimate will be reflected in the Space Act Agreement or other appropriate agreement means, such as Cooperative Agreements, or Interagency Agreements.

## 6. Proposal Selection Criteria

The selection of the proposed activity will be based upon responses given to questions in Section 4, and the consistency of the proposed activities with the ACTS or SOMO Charter in Section 2.

## 7. Effective Date

This policy is effective immediately.

## 8. ACTS Satellite & User Terminal Description

### 8.1 ACTS: Advanced Communication Technology Satellite

The ACTS Ka-band satellite was launched into orbit on September 12, 1993, and occupies the 100-degrees west longitude, in a Geo.-stationary orbit. The ACTS satellite is capable of operating in Base-Band Processor (BBP) mode, Microwave Switched Mode (MSM), or a mixed mode. Each mode of satellite operation allows for the usage of different user terminals described below. With its 900 MHz band-width, the ACTS satellite is a highly configurable testbed capable of operating at data rates of 622 Mega Bits Per Second (MBPS) using ACTS High Data Rate (HDR) terminals, or 4.8 Kilo-Bits Per Second using standard Ultra Small Aperture Terminals (USAT), and other data rates in between the two extremes. Our present estimates indicate that the ACTS satellite will run out of North-South Station Keeping Fuel in July of 1998. A feasibility analysis performed by NASA and its contractors has established the technical feasibility of ACTS operations, in an inclined orbit, through September of year 2000.

### 8.2 HDR: High Data Rate terminal characteristics are as follows:

- MSM Mode of Operation (3 U/L and 3 D/L channels at a time)
- Transportable system w/ walk in shelter
- Antenna: 3.4 m

- TDMA Burst Duration: 0.3 to 4.0 mS
- TDMA Frame Length: 32 mS
- Max EIRP: 76 dBw
- User Interface: SONET OC-3 and OC-12
- Max User Data Rate: 622 MBPS
- Modulation: BPSK (OC-3), O-QPSK (OC-12)
- Six units in the fleet, one unit is stationary at Glenn Research Center
- Pending approval, we plan to upgrade HDR terminals for Inclined Orbit Operations

#### 8.3 T1-VSAT: T1-Very Small Aperture Terminal characteristics are as follows:

- BBP Mode of Operation
- TDMA Frame Length: 1 mS
- U/L Burst Rate: 27.5 MBPS; D/L Burst Rate: 110 MBPS
- Antenna: 1.2 m/2.4 m reflector, feed assembly, mount, de-icer
- Max EIRP: 60/66 dBw; Max G/T: 16/22 dB/K
- Throughput: 28 X 64 KBPS (1.792 MBPS)
- Modulation format: SMSK for U/L & D/L
- Data Word Length: 64 bits
- Max BER: 5 E-07 (must maintain for 10 dB rain fade)
- Nineteen units in the fleet
- Pending approval, we plan to upgrade T1-VSAT terminals for Inclined Orbit Operations

#### 8.4 USAT: Ultra Small Aperture Terminal characteristics are as follows:

- MSM Mode of Operation
- Antenna: 0.36 m, 0.60 m

- HPA: 0.25 w, 1.0 w
- Max EIRP: 30 dBw, 40.5 dBw
- G/T: 6.4 dB/K
- Data Rate: 4.8 KBPS to 1.544 MBPS
- Five units in the fleet, plan to increase to 10
- Pending approval, we plan to upgrade USAT terminals for Inclined Orbit Operations

8.5 LET: Link Evaluation Terminal characteristics are as follows:

- MSM Mode of Operation
- Antenna: 4.7 m
- HPA: 10 to 60 w (variable)
- BW: 900 MHz
- EIRP: 68-76 dBw
- G/T: 27 dB/k
- Data Rates: Up to 220 MBPS
- One unit at Glenn Research Center. Not intended for relocation
- The LET is capable of inclined orbit operations with some required software upgrades

8.6 ACTS Mobile Terminal (AMT) characteristics are as follows:

- MSM Mode of Operation (two U/L and two D/L channels at a time)
- Portable and mobile system; has been installed in vans, HMMWV's, several different aircraft, several different ships, and a train for mobile operations
- Antenna: 26 inches in diameter, 6 inches in height (including radome)
- Maximum EIRP: 46 dBw
- Maximum G/T: 0 dB/K

- User Interfaces: RS-449, RS-232; conversion can be accomplished for most other standard serial interfaces
- Data Rate Range: 9.6 KBPS to 2.048 MBPS
- Modulation Schemes: BPSK, QPSK, O-QPSK
- Coding: Convolutional Coding ( $R=1/2$ ,  $1/3$ ) with Viterbi and Sequential
- Decoding, Reed Solomon concatenated coding (with interleaving)
- Three Complete terminals exist with additional spare subsystem components

#### 8.7 Master Ground Station (MGS)/NASA Ground Station

- The MGS is the ACTS Command, Ranging, and Telemetry (CR&T) terminal located at Glenn Research Center, and is used for all ACTS activities.
- The MGS must be upgraded for inclined orbit operations.

### 9. Overall ACTS Program Plan

The overall plan for the ACTS Program is to perform the following activities, in meeting the Charter of the ACTS and SOMO:

- Commence Inclined Orbit Operations starting in July, 1998, through September 2000.
- Upgrade ACTS user terminals and NASA Ground Station for operations in Inclined Orbit, based on Section 8 details.
- Initiate and execute reimbursable Space Act Agreements, Inter-Agency Agreements, Cooperative Agreements, or other appropriate forms of agreements with organizations implementing ACTS in meeting ACTS or SOMO Charter noted in Section 2.
- Complete present ACTS Technology Verification Experiments, and initiate new ACTS TVEs in support of resolving satellite communications technology issues posed by:
  - Commercial Communication Satellite Industry Developers & Users
  - NASA Mission Centers
  - Government Communication Satellite Developers & Users

- Conduct Adaptive Rain-Fade Compensation Experiments
- Initiate and Complete Inter-operability experiments in support of NII/GII Standards Development
- Complete ACTS Propagation Experiments.
- Demonstrate the potential of Commercial Communication Satellite Systems and Services, for use by NASA missions, other agencies, and the general public, through an initiation and execution of Space Act Agreements, Inter-Agency Agreements, Cooperative Agreements, or other appropriate forms of agreements.

## Appendix

### Estimation of Cost

#### ACTS Usage Cost Estimation

This information is provided to users of ACTS subsystems to facilitate a rough order of magnitude estimate of the costs incurred by NASA Glenn Research Center to perform experiments involving the ACTS flight and ground segments. All ACTS experiment and demonstration proposals are subject to approval through the ACTS Usage Policy.

Appropriate usages of ACTS subsystems are experiments and demonstration having to do with following activities. The following will be used as framework for determination of whether or not a proposal is fully or partially cost reimbursable:

1. ACTS Technology Verification Experiments (Non-reimbursable)
2. Experiments and demonstrations benefiting the United States in general (Partially Cost Reimbursable)
3. Experiments and demonstrations for a specific organization (Fully Cost Reimbursable)

The ACTS Management Team in conjunction with the Space Operations & Management Office, will make the determination as to which of the above categories a given experiment or demonstration proposal would fall under, and the type of agreement best appropriate for the given proposal.

Basis for computation of NASA Costs (see Notes 1 & 2):

Cost Element	Cost or Cost Rate (Dollars)
Civil Service (CS) Labor Cost:	\$47/Hour
Travel Cost:	Estimated per request
Direct Material Cost:	Estimated per request

	1 <sup>st</sup> Shift	2 <sup>nd</sup> Shift	3 <sup>rd</sup> Shift
ACTS Network Support Cost:	\$500/Hour	\$385/Hour	\$320/Hour
Support Contractor (SC) Labor Cost:	\$65/Hour		
ACTS Terminal Usage (VSAT):	\$150/Day/Terminal		
ACTS Terminal Usage (USAT):	\$140/Day/Terminal		
ACTS Terminal Usage (HDRT):	\$350/Day/Terminal		
Subtotal Cost:	Sum of CS Labor, Travel, Direct Material, ACTS Network Support, SC Labor, & ACTS Terminal Usage Costs		
Indirect Cost:	20% to 50% of subtotal cost		
Total Cost:	Subtotal plus Indirect cost		

Note 1: An actual cost estimate is highly dependent on the specific requirements of the unique experiment or demonstration proposal. An actual cost estimate, including the experiment/demonstration checkout requirements, will be made by NASA and communicated to experimenters upon receipt of a proposal.

Note 2: Please refer to the ACTS Experiments Program Overview and the ACTS Usage Policy on the WWW for further details.